

Astronomy News

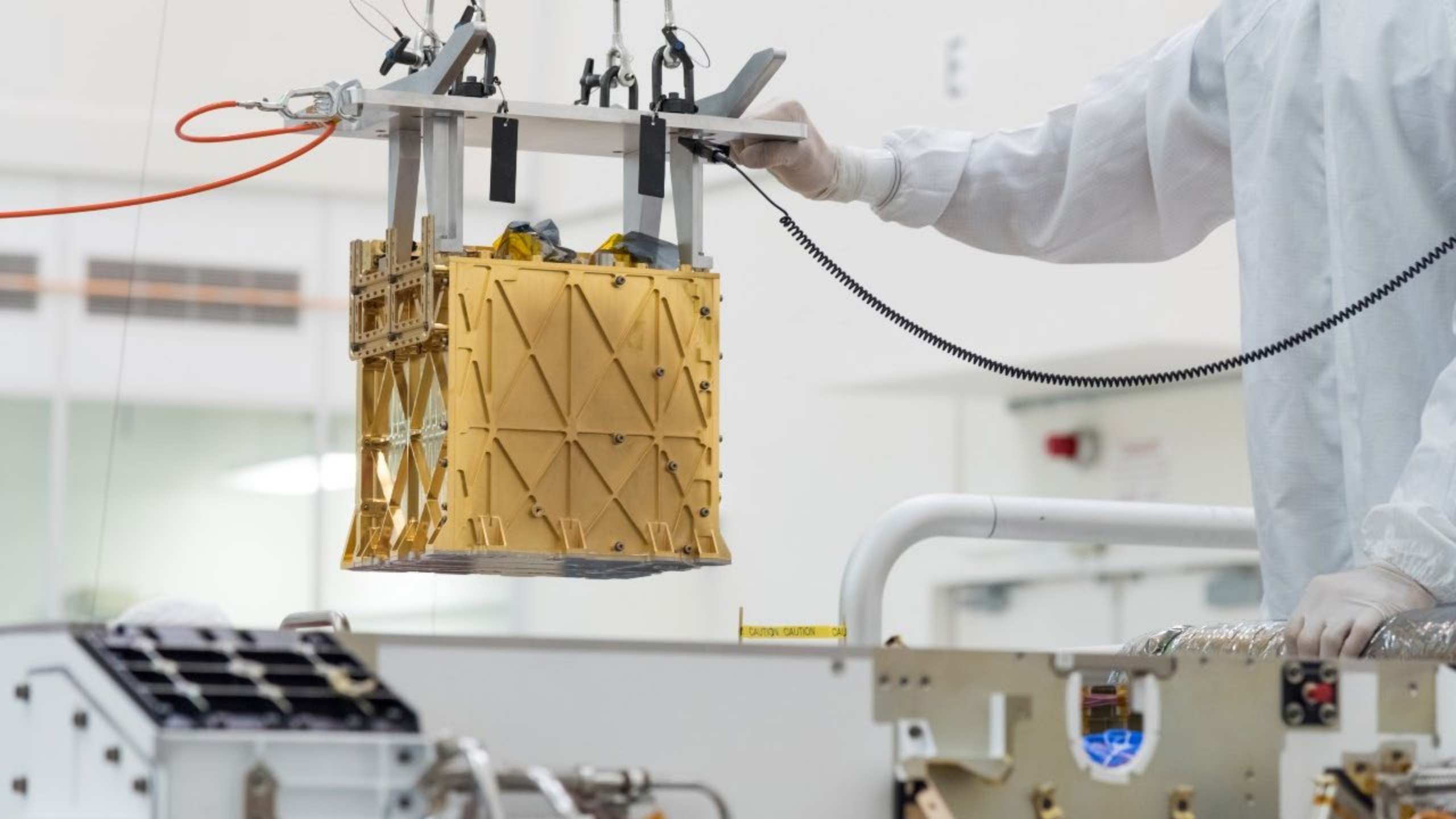
KW RASC FRIDAY APRIL 23RD
2021

JIM FAIRLES



NASA's Ingenuity Mars Helicopter Logs Second Successful Flight

- ▶ <https://www.nasa.gov/feature/jpl/nasa-s-ingenuity-mars-helicopter-logs-second-successful-flight>
- ▶ <https://www.youtube.com/watch?v=gNqWuM6-1vI>
- ▶ NASA's Ingenuity helicopter successfully completed its second Mars flight on April 22 – the 18th sol, or Martian day, of its experimental flight test window. Lasting 51.9 seconds, the flight added several new challenges to the first, which took place on April 19, including a higher maximum altitude, longer duration, and sideways movement.
- ▶ For this second flight test at “Wright Brothers Field,” Ingenuity took off again at 5:33 a.m. EDT (2:33 a.m. PDT), or 12:33 p.m. local Mars time. But where Flight One topped out at 10 feet (3 meters) above the surface, Ingenuity climbed to 16 feet (5 meters) this time. After the helicopter hovered briefly, its flight control system performed a slight (5-degree) tilt, allowing some of the thrust from the counter-rotating rotors to accelerate the craft sideways for 7 feet (2 meters).



NASA's Perseverance Mars Rover Extracts First Oxygen from Red Planet

- ▶ <https://www.nasa.gov/press-release/nasa-s-perseverance-mars-rover-extracts-first-oxygen-from-red-planet>
- ▶ The growing list of “firsts” for Perseverance, NASA's newest six-wheeled robot on the Martian surface, includes converting some of the Red Planet's thin, carbon dioxide-rich atmosphere into oxygen. A toaster-size, experimental instrument aboard Perseverance called the Mars Oxygen In-Situ Resource Utilization Experiment (MOXIE) accomplished the task. The test took place April 20, the 60th Martian day, or sol, since the mission landed Feb. 18.
- ▶ While the technology demonstration is just getting started, it could pave the way for science fiction to become science fact – isolating and storing oxygen on Mars to help power rockets that could lift astronauts off the planet's surface. Such devices also might one day provide breathable air for astronauts themselves. MOXIE is an exploration technology investigation – as is the Mars Environmental Dynamics Analyzer (MEDA) weather station – and is sponsored by NASA's Space Technology Mission Directorate (STMD) and Human Exploration and Operations Mission Directorate.

THE DRAKE EQUATION

What is the Drake equation?

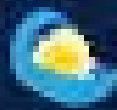
It is a scientific equation for Frank Drake that tries to estimate of unknown theoretical number of intelligent alien civilizations better our galaxy.

$$N = R^* \times f_p \times n_c \times f_l \times f_i \times f_c \times L$$

How it does work?

$$R^* \times f_p \times n_c \times f_l \times f_i \times f_c \times L = N$$

The number of stars that are born in our galaxy



The fraction of stars that have planets orbiting



The number of planets that are suitable for supporting life in our galaxy



The fraction of planets that actually develop life



The fraction of planets that develop intelligent life



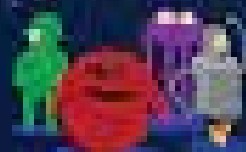
The fraction of planets that develop intelligent life that are capable of communicating



The number of planets that are capable of communicating that are actually communicating



The number of planets that are actually communicating that are actually communicating



Drake Equation

- ▶ <https://www.seti.org/drake-equation-index>
- ▶ N = The number of civilizations in the Milky Way galaxy whose electromagnetic emissions are detectable.
- ▶ R^* = The rate of formation of stars suitable for the development of intelligent life (number per year).
- ▶ f_p = The fraction of those stars with planetary systems.
- ▶ n_e = The number of planets, per solar system, with an environment suitable for life.
- ▶ f_l = The fraction of suitable planets on which life actually appears.
- ▶ f_i = The fraction of life bearing planets on which intelligent life emerges.
- ▶ f_c = The fraction of civilizations that develop a technology that produces detectable signs of their existence.
- ▶ L = The average length of time such civilizations produce such signs (years).

There are 100 scientists at the SETI Institute, working on nearly 100 research questions. But each of these topics can be related to one of the terms in the Drake Equation.

N~1: Alone in the Milky Way

presented by Dr. Pascal Lee

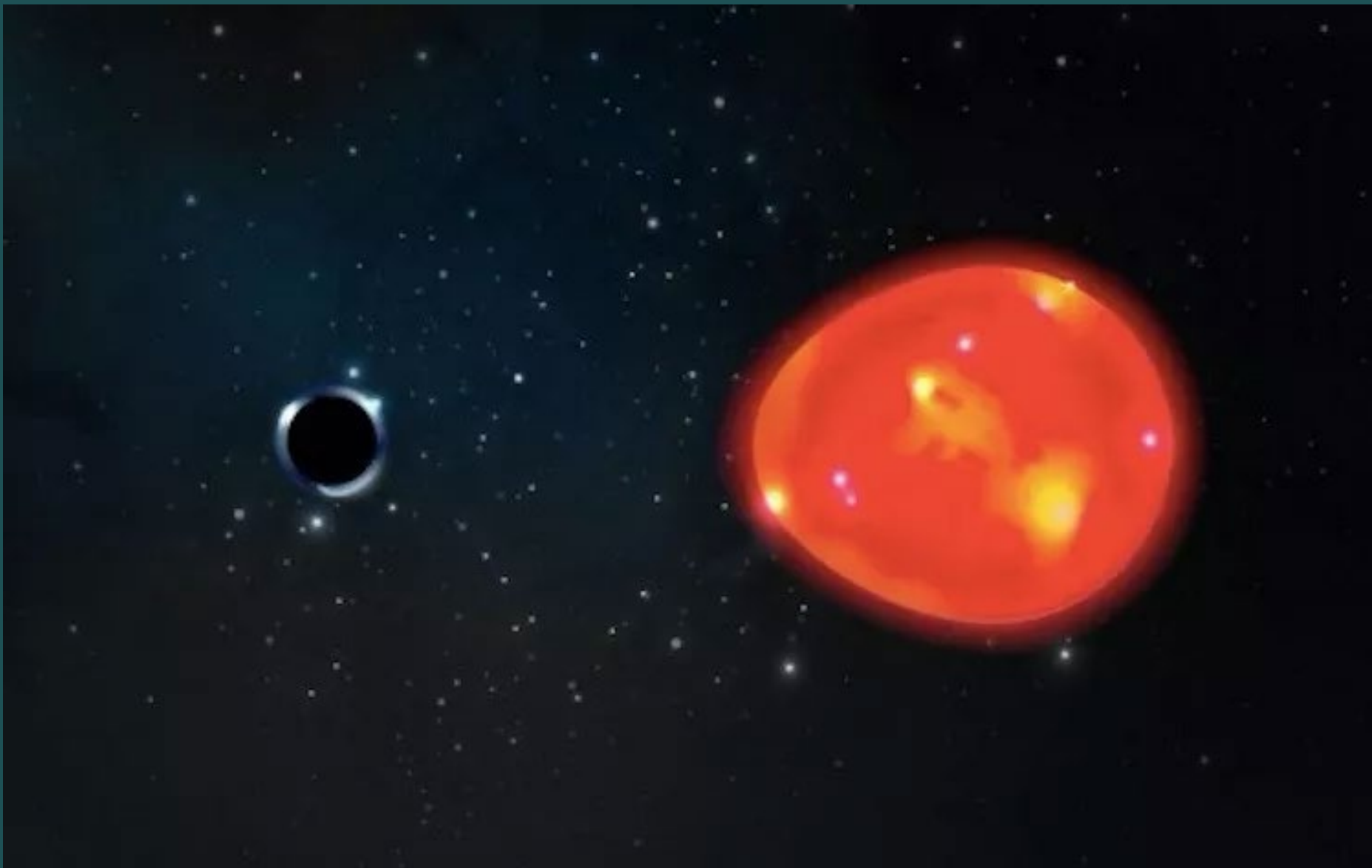
- ▶ <https://youtu.be/wj5nmgoQr50> Kalamazoo Astronomy meeting
- ▶ At the heart of the Search for Extraterrestrial Intelligence (SETI) lies the Drake Equation, a mathematically simple yet fascinatingly enigmatic formula proposed by American astronomer and SETI founder Frank Drake. The Drake Equation provides a way to estimate of the number, N, of advanced civilizations present in our galaxy. Although N is often assumed to be a large number - there would be many civilizations in the Milky Way galaxy - large numbers for N are in apparent conflict with observation, a contradiction known as the Fermi Paradox, named after Italian-American physicist and 1938 Nobel Prize winner Enrico Fermi.
- ▶ Dr. Lee examines the state-of-the-art of our knowledge about each term of the Drake Equation, and reaches the surprising conclusion that N might actually be a very small number, close to 1. We could be IT. The implications of N~1 are profound and will be discussed. About the Speaker: Pascal Lee is chairman of the Mars Institute, senior planetary scientist at the SETI Institute, and director of the NASA Haughton-Mars Project (HMP) at NASA Ames Research Center at Moffett Field, CA. He holds an ME in geology and geophysics from the University of Paris, and a PhD in astronomy and space sciences from Cornell University. He was Joseph Veverka's last graduate student and Carl Sagan's last T.A."

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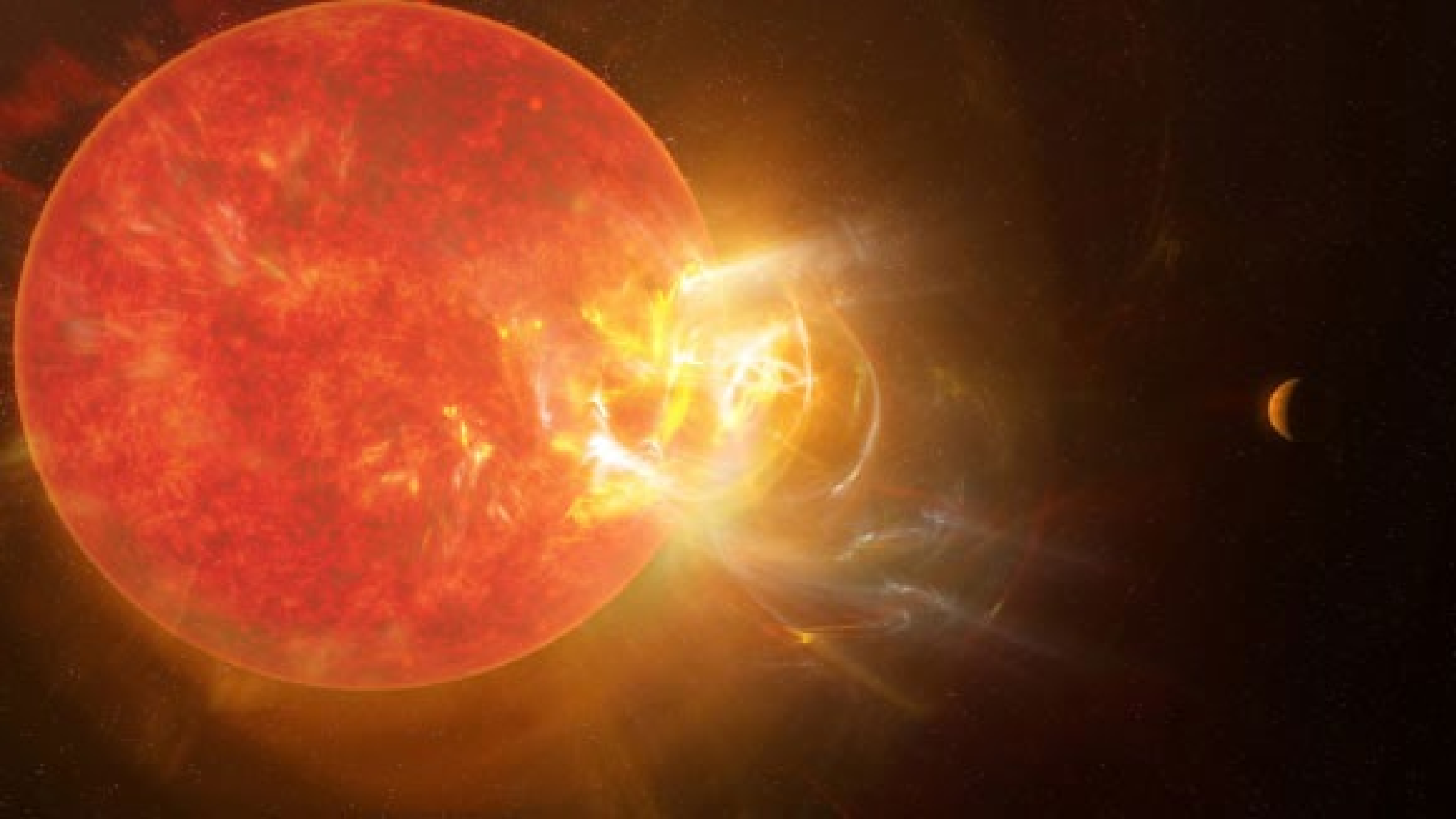
Astronomers map asteroid's 22m-year journey to Earth

- ▶ <https://www.theguardian.com/science/2021/apr/23/astronomers-map-asteroids-22m-year-journey-to-earth>
- ▶ Flight path of Kalahari's six-tonne asteroid is first tracing of meteorite shedding rock to solar system origin
- ▶ Astronomers have reconstructed the 22m-year-long voyage of an asteroid that hurtled through the solar system and exploded over Botswana, showering meteorites across the Kalahari desert.
- ▶ It is the first time scientists have traced showering space rock to its source – in this case Vesta, one of largest bodies in the asteroid belt that circles the sun between Jupiter and Mars.
- ▶ The six-tonne asteroid punched into Earth's atmosphere at 37,000mph in June 2018 and broke apart above the central Kalahari game reserve, creating a fireball nearly as bright as the sun. Immediate searches of the presumed landing site found a small meteorite, which was named Motopi Pan.



Tiny newfound 'Unicorn' is closest known black hole to Earth

- ▶ <https://www.space.com/tiny-black-hole-unicorn-closest-to-earth>
- ▶ 'The Unicorn' lies a mere 1,500 light-years from us and is just three times more massive than the sun.
- ▶ Astronomers have apparently found the closest known black hole to Earth, a weirdly tiny object dubbed "The Unicorn" that lurks just 1,500 light-years from us.
- ▶ The nickname has a double meaning. Not only does the black hole candidate reside in the constellation Monoceros ("the unicorn"), its incredibly low mass — about three times that of the sun — makes it nearly one of a kind.
- ▶ "Because the system is so unique and so weird, you know, it definitely warranted the nickname of 'The Unicorn,'" discovery team leader Tharindu Jayasinghe, an astronomy Ph.D. student at The Ohio State University, said in a new video the school made to explain the find.

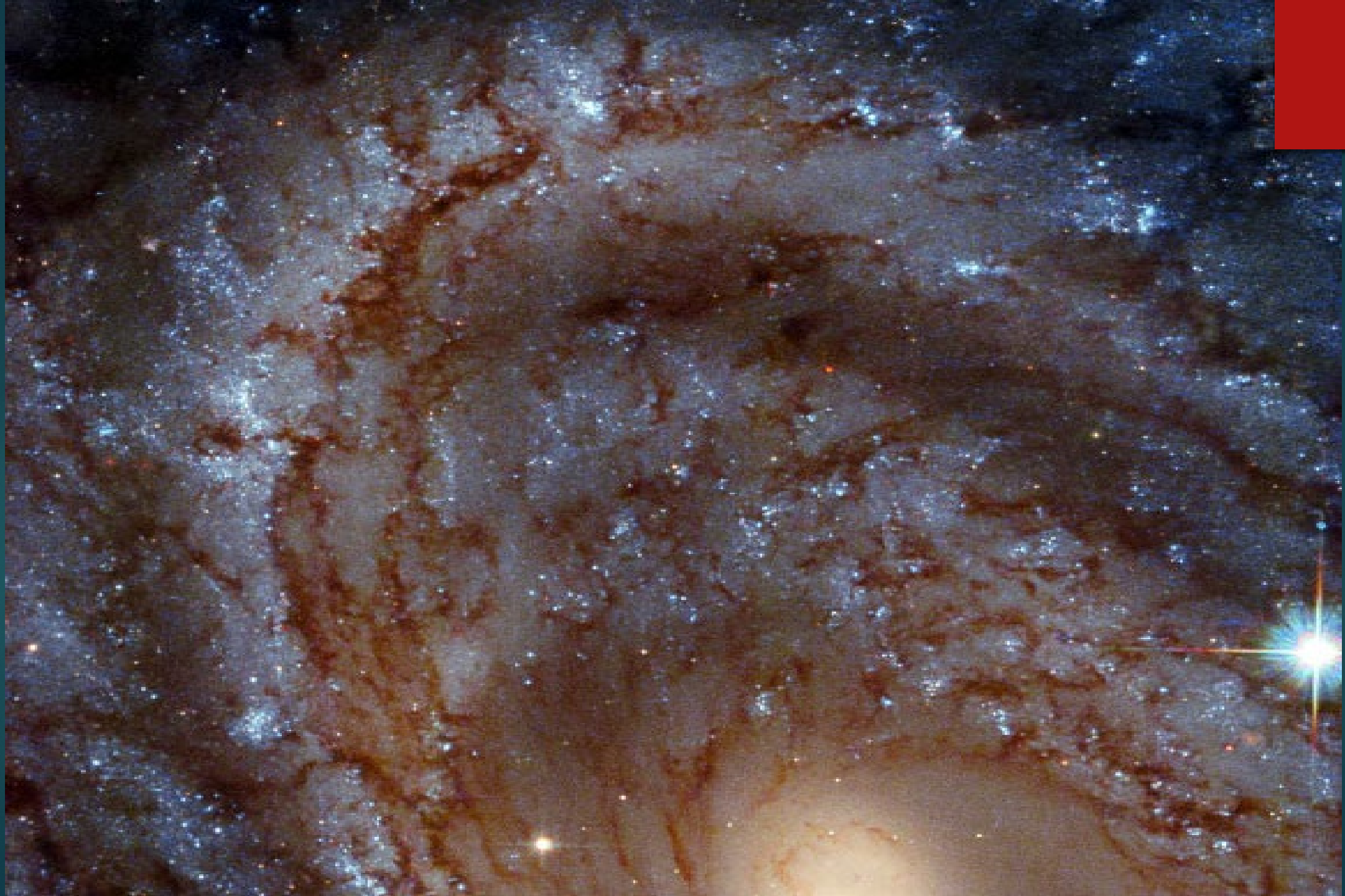


Astronomers Detect Extreme Flare from Proxima Centauri

- ▶ <http://www.sci-news.com/astronomy/extreme-flare-proxima-centauri-09579.html>
- ▶ Using the Australian Square Kilometre Array Pathfinder (ASKAP), the Atacama Large Millimeter/submillimeter Array (ALMA), the NASA/ESA Hubble Space Telescope, NASA's Transiting Exoplanet Survey Satellite, and the du Pont Telescope, astronomers have observed the largest flare ever recorded from Proxima Centauri, the Sun's closest stellar neighbor and one of the best-studied low-mass stars.
- ▶ In a campaign carried out over several months, Dr. MacGregor and colleagues observed Proxima Centauri using ground- and space-based telescopes.
- ▶ They discovered an extreme flaring event on May 1, 2019, with five telescopes that traced its timing and energy in unprecedented detail.

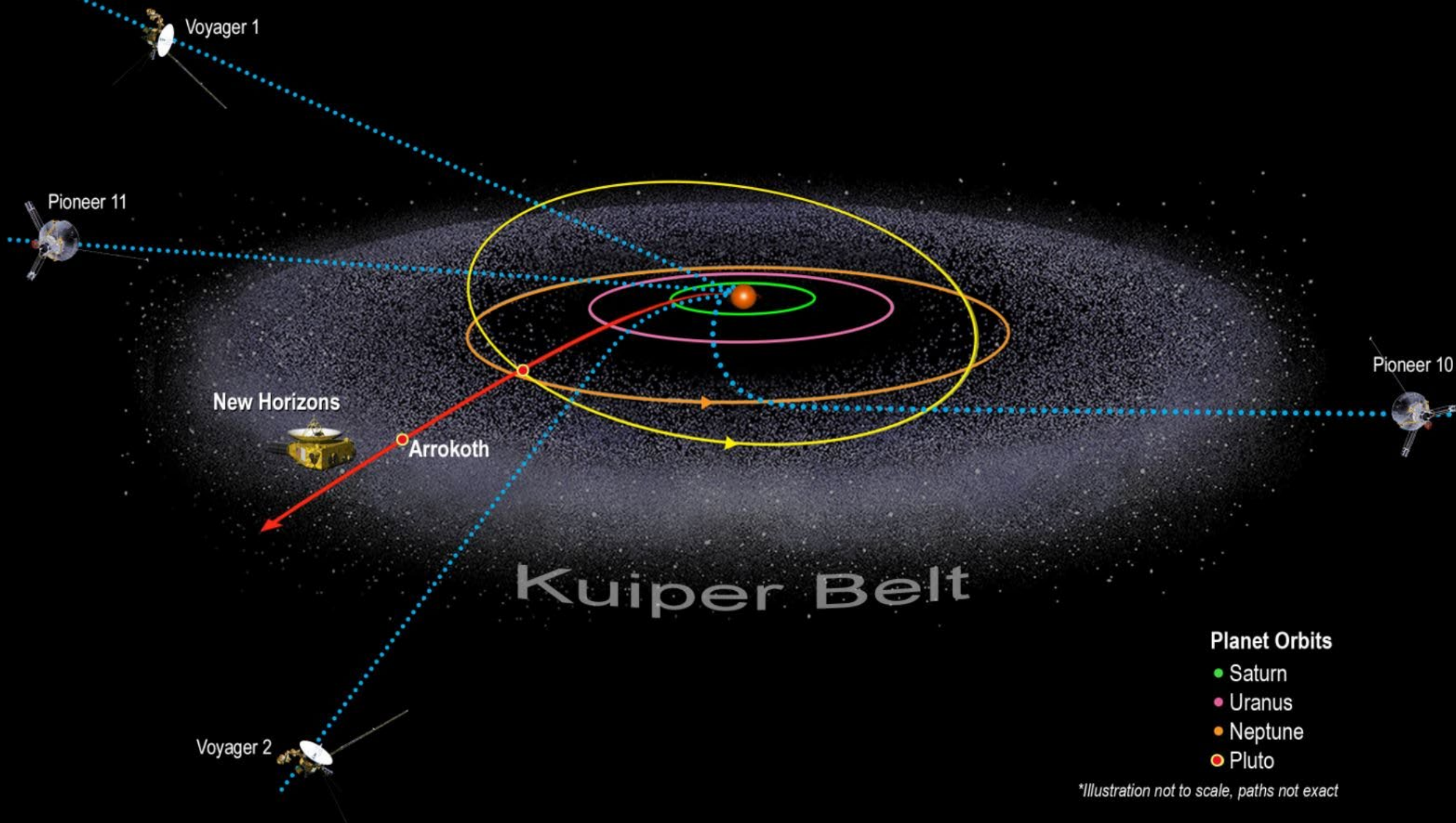
Astronomers Detect Extreme Flare from Proxima Centauri

- ▶ “Now we know these very different observatories operating at very different wavelengths can see the same fast, energetic impulse,” said Dr. Alycia Weinberger, an astronomer in the Earth & Planets Laboratory at the Carnegie Institution for Science.
- ▶ The May 1, 2019 flare lasted just 7 seconds, and is the brightest ever detected in the millimeter and far-ultraviolet wavelengths.
- ▶ “The star went from normal to 14,000 times brighter when seen in ultraviolet wavelengths over the span of a few seconds,” Dr. MacGregor said.
- ▶ In all, the flare was roughly 100 times more powerful than any similar flare seen from our Sun.
- ▶ “Proxima Centauri’s planets are getting hit by something like this not once in a century, but at least once a day if not several times a day,” Dr. MacGregor said.
- ▶ “There will probably be even more weird types of flares that demonstrate different types of physics that we haven’t thought about before.”



Hubble Zooms In on Magnificent Spiral Galaxy: NGC 4603

- ▶ <http://www.sci-news.com/astronomy/hubble-spiral-galaxy-ngc-4603-09565.html>
- ▶ Astronomers using the NASA/ESA Hubble Space Telescope have produced a spectacularly detailed image of a part of the spiral galaxy NGC 4603.
- ▶ is located approximately 107 million light-years away in the constellation of Centaurus.
- ▶ This galaxy was discovered on June 8, 1834 by the English astronomer John Herschel.
- ▶ Otherwise known as ESO 322-52, IRAS 12382-4042 and LEDA 42510, it has a diameter of 110,000 light-years.
- ▶ NGC 4603 is a member of the Centaurus Cluster of galaxies, a group of over 100 galaxies.
- ▶ The galaxy is classified as SA(s)c, meaning it is a pure spiral galaxy with relatively loosely-wound arms.
- ▶ “In the last years of the twentieth century, the galaxy was keenly and closely watched for signs of a peculiar class of stars known as Cepheid variables.”
- ▶ “These stars have a luminosity closely tied to the period with which they darken and brighten, allowing astronomers to accurately measure how far they are from Earth.”



Voyager 1

Pioneer 11

New Horizons

Arrokoth

Voyager 2

Pioneer 10

Kuiper Belt

Planet Orbits

- Saturn
- Uranus
- Neptune
- Pluto

**Illustration not to scale, paths not exact*

New Horizons is Now 50 Astronomical Units Away From the Sun

- ▶ <https://www.universetoday.com/150980/new-horizons-is-now-50-astronomical-units-away-from-the-sun/>
- ▶ As the New Horizons spacecraft hurtles out towards interstellar space, it has now reached an historical milestone. On April 17, 2021, New Horizons passed 50 astronomical units, or 50 times Earth's distance from the Sun. It is just the 5th spacecraft to reach that distance, joining the Voyagers 1 and 2 and the Pioneers 10 and 11.
- ▶ “Although four other missions reached this distance back in the 20th Century, none was in perfect health, but New Horizons is,” said New Horizons' principal investigator Alan Stern, on Twitter. “This is an amazing testament to the skill, care, and attention to detail of those who designed and built New Horizons and those who have been its flight crew now for over 15 years.”
- ▶ This summer, it will be six years since New Horizons made its flyby of Pluto and its system of Moons in July of 2015.



Quantum Astronomy Could Create Telescopes Hundreds of Kilometers Wide

- ▶ <https://www.scientificamerican.com/article/quantum-astronomy-could-create-telescopes-hundreds-of-kilometers-wide/>
- ▶ Astronomers hope to use innovations from the subatomic world to construct breathtakingly large arrays of optical observatories
- ▶ It is impossible, at least, without a helping hand from quantum physics. In 2011 Daniel Gottesman of the Perimeter Institute for Theoretical Physics in Ontario and his colleagues suggested putting a source of entangled photons midway between two distant telescopes. The source sends one of a pair of entangled photons to each telescope, where the particles are made to interfere with another photon received from a celestial target. The interference measurements in each telescope can be recorded and later used to reconstruct an interferogram. Although this may sound simple in principle, longer baselines for optical interferometry would require quantum repeaters—expensive and complex custom-built devices for distributing entanglement over great distances that are the antithesis of off-the-shelf tech.

Quantum Astronomy Could Create Telescopes Hundreds of Kilometers Wide

- ▶ Now Bland-Hawthorn has teamed up with quantum technologist John Bartholomew of the University of Sydney and Matthew Sellars of the Australian National University in Canberra to design optical interferometers that avoid the use of entangled photons and quantum repeaters. The basic idea is simple: Consider two eight-meter telescopes separated by tens of kilometers. The quantum states of the photons collected by each telescope—meaning the amplitude and phase of light as a function of time—are stored in quantum hard drives. Astronomers would physically transport these QHDs—by road, rail or air—to one location, where the quantum states would be read out and made to interfere, generating an interferogram.



Satellite skyglow may make it impossible to avoid light pollution

- ▶ <https://astronomy.com/news/2021/04/satellite-skyglow-may-mean-light-pollution-is-unavoidable>
- ▶ Calculations suggest satellites are already making it harder to find truly dark skies.
- ▶ In the past few years, astronomers have raised concerns about the growing number of satellites being launched — especially the megaconstellations launched by companies like SpaceX. When satellites streak overhead, they can disrupt naked-eye observing and astrophotography, as well as observations by professional telescopes.
- ▶ Now, a paper published online March 29 in the Monthly Notices of the Royal Astronomical Society highlights another concern: Even when satellites and other objects in orbit are too dim to be resolved by the naked eye, they collectively scatter enough light back into the atmosphere that it produces a diffuse glow similar to light pollution from cities.
- ▶ According to the researcher's calculations, this light pollution from satellites and other small objects in orbit, such as debris and particles, can increase the natural sky brightness by 10 percent — a threshold that the International Astronomical Union (IAU) warned in 1979 was too high for astronomical observatories — when overhead.

Questions?

